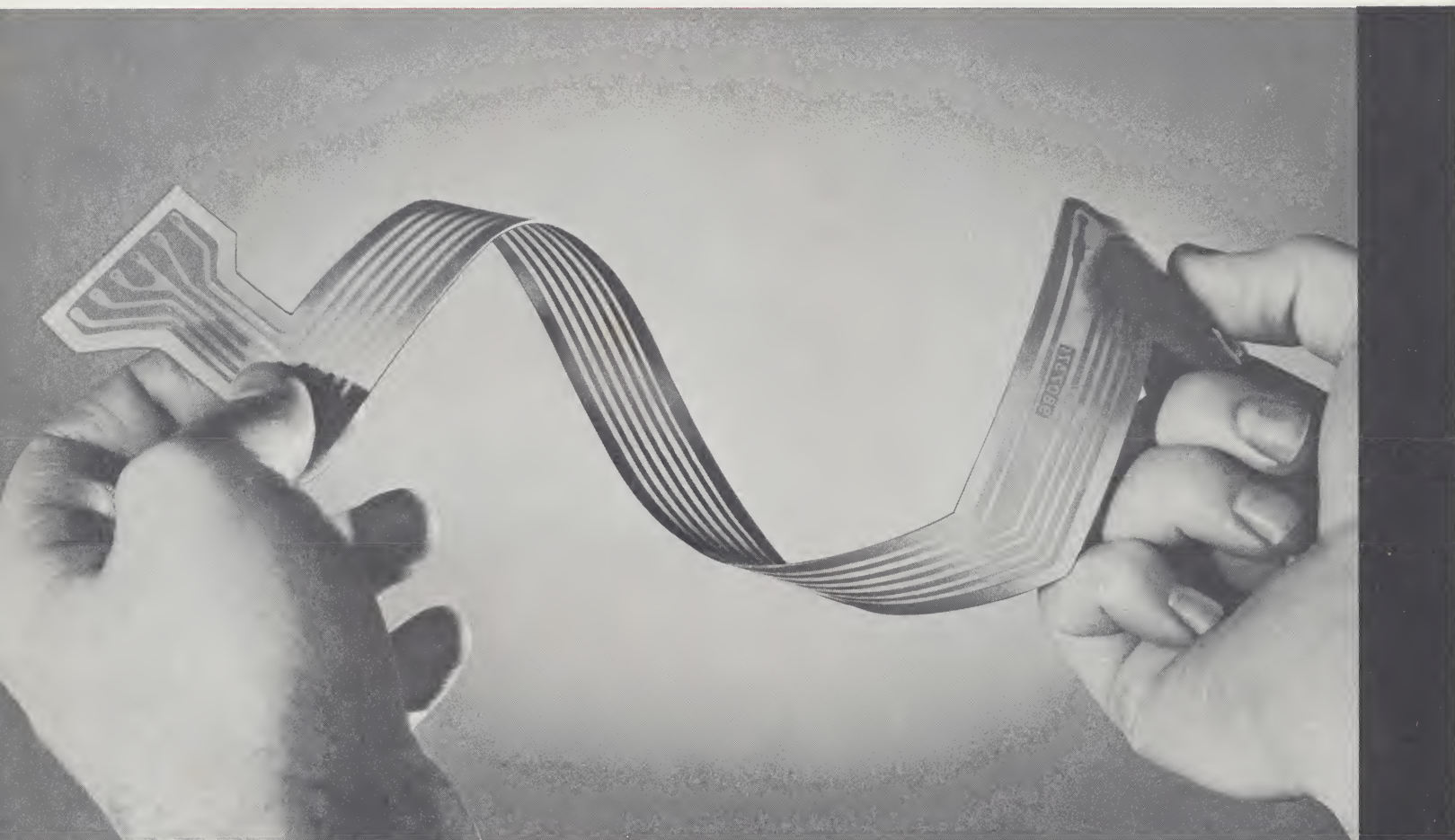


# SCHJEL-CLAD\* Product Bulletin

from G. T. Schjeldahl Co.



*Schjel-Clad* copper-Mylar† is a unique laminate of copper bonded to Mylar polyester film for printed circuits and printed wiring applications. The adhesive, a thermosetting bond developed especially for *Schjel-Clad*, assures high purity and high bond strength in the lamination; its thermo properties make the laminate resistant to moisture and most solvents.

\*G. T. Schjeldahl Co., T.M. Reg. U.S. Pat. Off.

Low distortion of etched *Schjel-Clad* circuits is proof of its high dimensional stability. *Schjel-Clad* circuits will operate with minimum distortion in sustained elevated temperatures. *Schjel-Clad* is fabricated only with high purity electrodeposited or rolled copper to provide optimum system performance over a wide range of applications.

†duPont trademark for its polyester film

ANOTHER  
SCHJELDAHL  
MATERIALS  
ADVANCEMENT



*Putting Materials Together Through Chemistry and Mechanical Design*

**G.T. Schjeldahl Co.**

SAY "SHELL-DOLL" • NORTHFIELD, MINNESOTA

# Product Bulletin

SCHJEL-CLAD

## ELECTRICAL AND PHYSICAL DATA

Test results reported below are for GT-607, a 1-ounce electrodeposited copper by 2-mil type A Mylar film. Tests were performed by an independent laboratory, in accordance with standard ASTM methods designation D149-59 in air.

### A. DIELECTRIC STRENGTH

Cond. A.

2-inch disc electrodes . . . 3800 to 4500 volts  
per mil

### B. DIELECTRIC CONSTANT AT 1 MC

Cond. A. . . . . 3.25

### C. DISSIPATION FACTOR

Cond. A. . . . . 0.027

### D. VOLUME RESISTIVITY AT 500 VDC

(Ohms per inch)

Cond. A. . . . . Exceeds  $10^{15}$

Cond. C. . . . . Exceeds  $10^{15}$

### E. SURFACE RESISTANCE AT 500 VDC

(Ohms per inch)

Cond. A. . . . . Exceeds  $10^{13}$

Cond. C. . . . . Exceeds  $10^{13}$

Cond. A. Etched Surface . . . . . Exceeds  $10^{13}$

Cond. C. Etched Surface . . . . . Exceeds  $10^{13}$

### F. BOND STRENGTH\* . . . . . Exceeds material strength—8.1 psi

\*Bond strength tests were performed at the Schjeldahl Company. Tests represent an average of 16 one-inch samples of 3-ounce rolled copper by 5-mil Type A Mylar, peeled at a 90-degree angle at 2 inches per minute.

## HANDLING TECHNIQUES

*Schjel-Clad* is easily adaptable to high-speed circuit etching processes. The dimensional stability of the etched material allows processing in a continuous roll to achieve maximum productivity at a minimum labor cost. In the manufacture of a flexible circuit or harness, fabricators generally use ferric chloride, ammonium persulfate, or copper chloride as the etchant.

Silk screen printed circuit inks are commonly used as the resist, while high quality, precision etching generally required photo resist techniques. Most resists can be removed with trichloroethylene.

Precleaned rolled copper and oxide treated copper laminates will withstand more severe processing conditions than will electrodeposited copper laminates.

## APPLICATIONS

*Schjel-Clad* copper-Mylar can be used as a flexible circuit or as a mounted, folded, or stacked circuit. Consistently high bond strength permits severe flexing to reduce space requirements in a circuit package. Applications listed below indicate the wide range of potential uses for *Schjel-Clad*.

- Aerospace and missile wire harnesses
- Computer wiring
- Memory system drive and readout array
- Shielding complete units and harnesses
- Tamper-proof construction
- Multilayer circuits
- Delay lines and strip lines
- Switches
- Flat capacitor arrays
- Television and radio circuits
- Automotive wiring

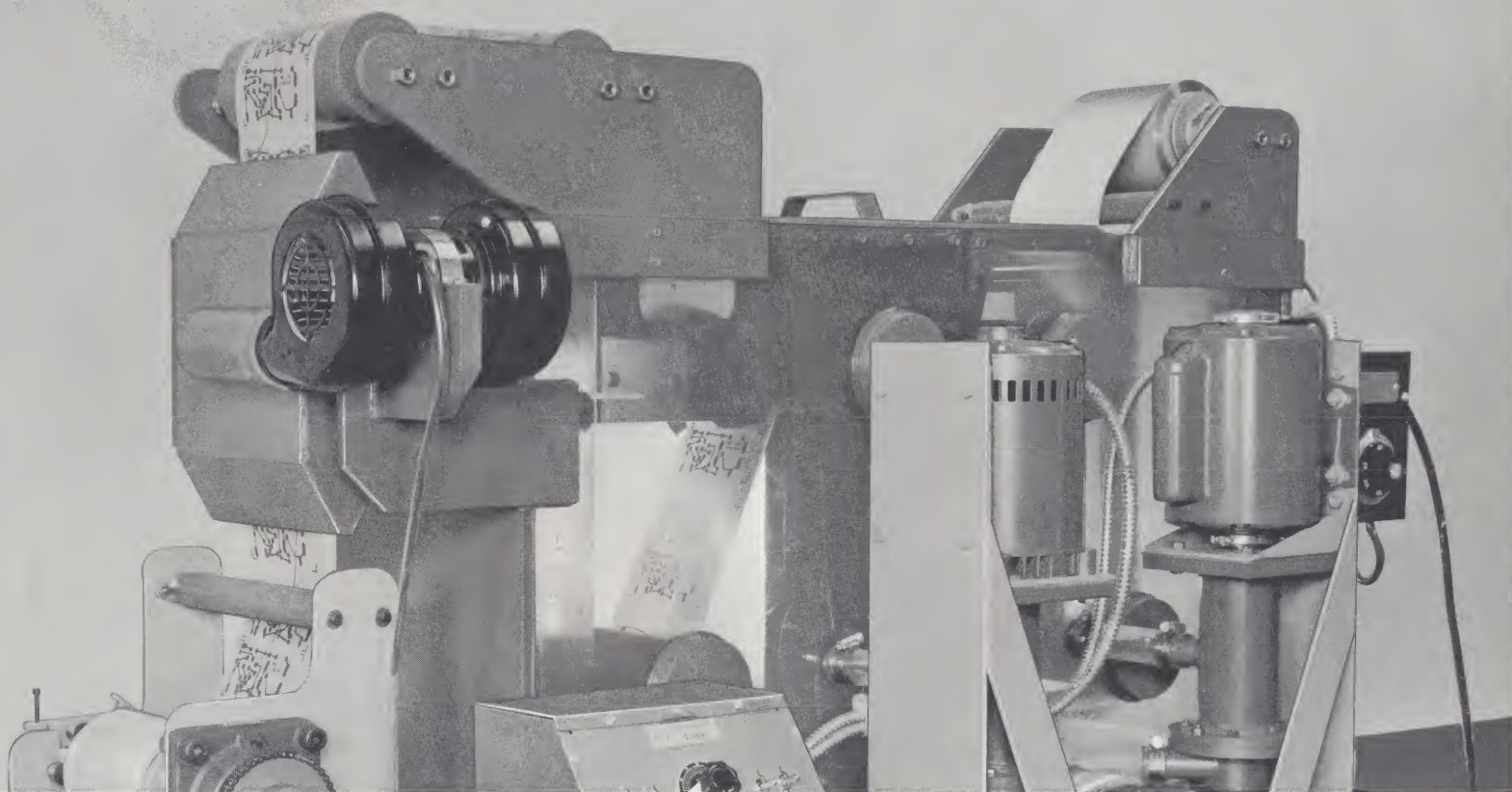
Automotive dash panels, wired with *Schjel-Clad*, have substantially increased reliability and efficiency. *Schjel-Clad* can be used for inter-connecting modules where high capacity, low bulk, and light-weight wiring is needed.

## QUALITY CONTROL

Quality is assured and maintained in *Schjel-Clad* on each shipment through an extensive series of in-process controls. Bond strength is tested on each production run and samples are evaluated for etching characteristics.

Bond strength data and etched samples corresponding to roll numbers shipped are available on request. This data will represent random sampling of a production run. 100 per cent material inspection is performed *in process* on all *Schjel-Clad* laminates and records are available indicating the condition of the material that is shipped.

Continuous, in-line, roll-to-roll  
circuit etcher, designed by  
G. T. Schjeldahl Company.  
Enables continuous etching of  
flexible Schjel-Clad laminates.  
Additional information and prices  
will be furnished on request.



## AVAILABILITY

Schjel-Clad copper-Mylar is available in a variety of grades and thicknesses of copper. The chart at right lists standard grades available from stock. Three types of copper are available.

- A. Standard electrodeposited (printed circuit quality).  
Used for conventional print wire applications. Bond strength of laminates using this copper average approximately 6 pounds per inch width.
- B. Oxide Treated Copper (printed circuit quality)  
Permits etching of extremely narrow conductors. It is also more resistant to severe chemical processes. Bond strengths of up to 15 pounds per inch width are achieved.
- C. Soft Pre-Cleaned Rolled Copper  
Used where high degree of durability and flexibility is needed. Bond strengths average approximately 8 pounds per inch width.

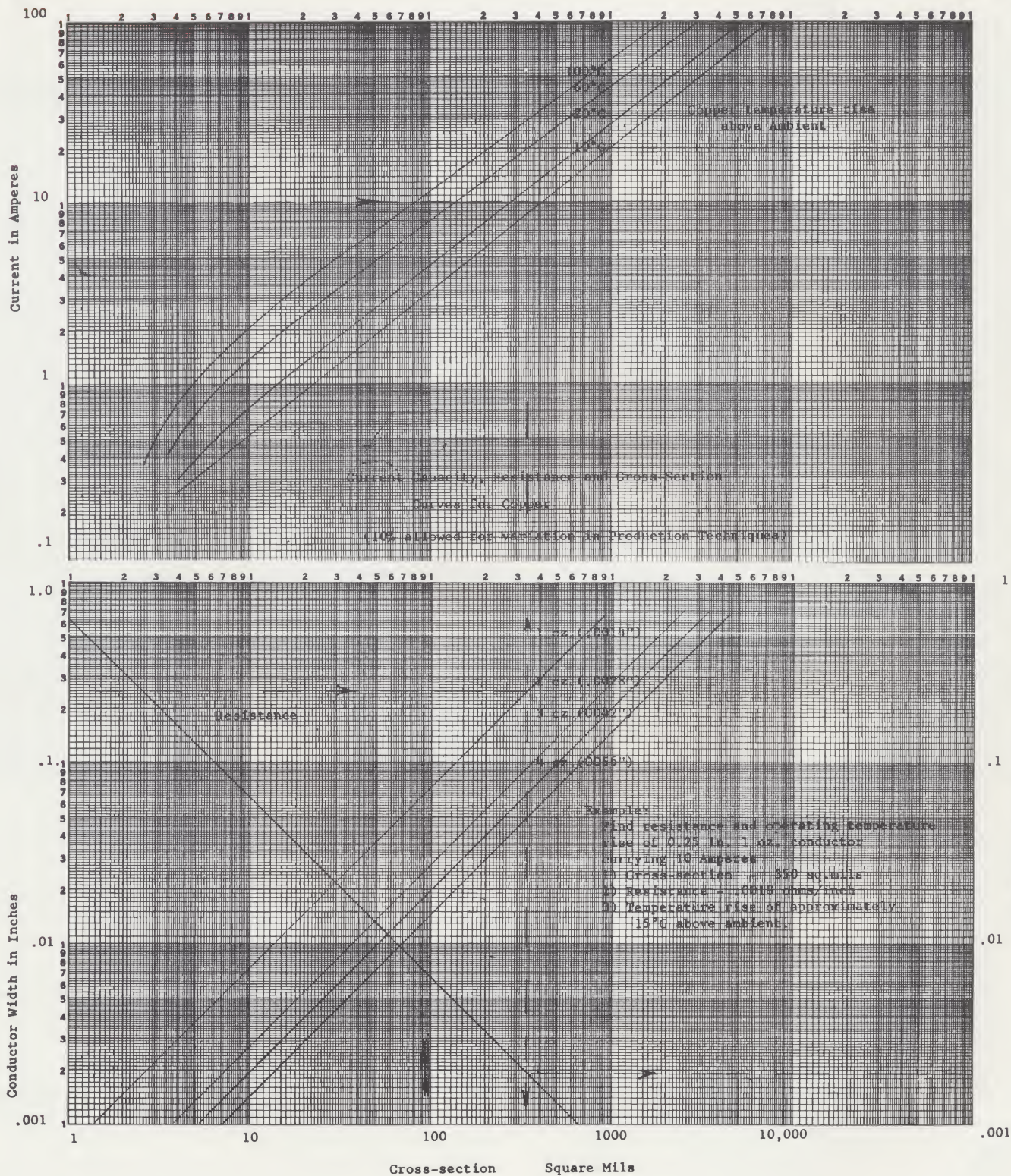
## STANDARD SCHJEL-CLAD COPPER-MYLAR LAMINATIONS\*

GRADE	COMPOSITE	NOMINAL THICKNESS (INCHES)	FORM	WIDTH (INCHES)
GT-606	1 oz. copper x 1-mil A Mylar	0.0029	Roll	19
GT-608	1 oz. copper x 3-mil A Mylar	0.0049	Roll	19
GT-620	2 oz. copper x 5-mil A Mylar	0.0083	Roll	19
GT-612-1	1 oz. copper x 1-mil A Mylar x 1 oz. copper	0.0048	Sheet	19
GT-619-1	2 oz. copper x 3-mil A Mylar x 2 oz. copper	0.0096	Sheet	19

\*Information on custom laminations will be provided on request.

# Product Bulletin

## Current vs Temperature Rise/Schjel-Clad Copper Mylar



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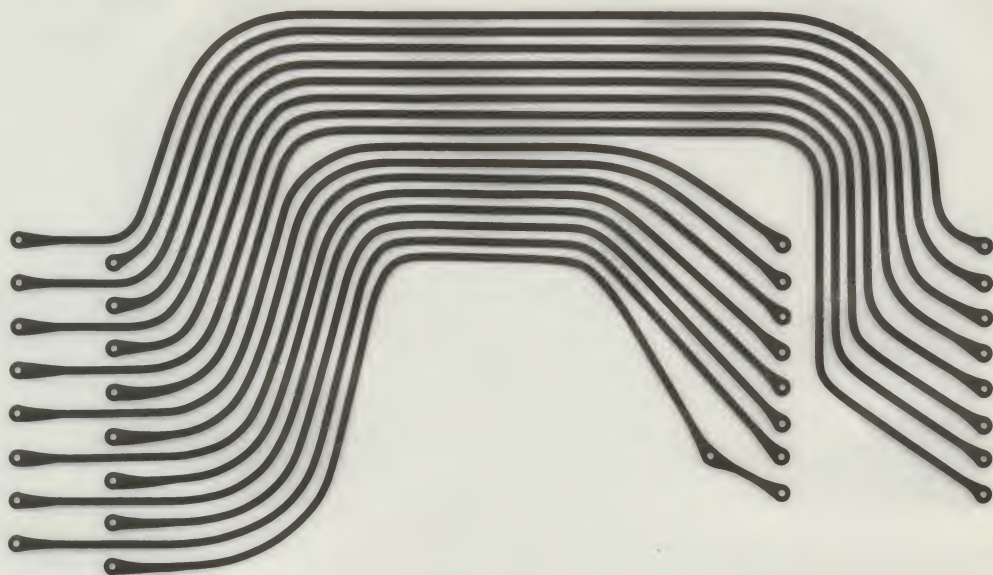
# SCHJEL-CLAD<sup>®</sup> PRECISION FLEXIBLE CIRCUIT

PROCESSED ON THE GT-1232 CONTINUOUS ETCHER

MATERIAL COMPOSITE-MYLAR\* AND PRINTED CIRCUIT  
QUALITY COPPER FOIL, BONDED WITH SCHJELBOND

OTHER LAMINATES AVAILABLE WITH FEP TEFLON\*,  
H-FILM, AND POLYPROPYLENE, BONDED TO ALUMINUM,  
NICKEL, NICKEL ALLOYS, AND LEAD

\* DuPont Trademark



*ANOTHER QUALITY ENGINEERED MATERIAL  
FROM*

PRODUCTS



SERVICES

G.T. Schjeldahl Co.

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